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JANUARY 2019

Going Electric - The Future of London's Buses

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Introduction

Globally, more and more cities are moving to electrify their bus fleets in a bid to advance clean, sustainable and innovative transportation.

Last June, the Mayor of London announced that 68 new electric double-deckers would join London's bus fleet this summer, boasting the capital would become home to 'Europe's largest double-decker electric bus fleet'.[1]

But the Mayor's boast is futile – double deckers are rare in most European cities which largely favour single decker buses and trams instead. In fact, only Dublin compares in terms of the percentage of its fleet composed of double deckers.[2]

Further still, while it is of course welcome that the Mayor is looking at growing the electric bus fleet, both he and TfL should refrain from making boastful claims about their success in this area.

In December, I confronted the Mayor over his progress in rolling out electric buses. He told me "London will have 150 zero-emissions vehicles in early 2019, making it one of the largest city fleets in the world".[3] This is not the case.

Indeed, given that London has a fleet of approximately 9300 buses, even if the Mayor meets his further target of having 240 pure electric buses by the end of 2019, less than 2.6 per cent of the capital's fleet would be be electric – an underwhelming statistic.

And let's compare this to Shenzhen - a modern metropolis linking Hong Kong to China's mainland - which boasts an entirely electric fleet, while China as a whole adds a London-sized electric bus fleet to its roads every five weeks.[4]

[1]https://www.london.gov.uk/press-releases/mayoral/london-to-have-europes-largest-electric-bus-fleet
[2] As at November 2018, the state-owned 'Dublin Bus' fleet consisted of 1016 buses, of which 1014 are double deckers. http://www.dublinbus.ie/About-Us/Dublin-Bus-Fleet/
[3]https://www.london.gov.uk/moderngov/documents/b18173/Minutes%20-%20Appendix%202%20-%20Questions%20to%20the%20Mayor%20Thursday%2020-Dec-2018%2010.00%20London%20Assembly%20Mayors%20.pdf?T=9
[4] https://www.wri.org/blog/2018/04/how-did-shenzhen-china-build-world-s-largest-electric-bus-fleet and https://www.weforum.org/agenda/2018/04/china-is-adding-a-london-sized-electric-bus-fleet-every-five-weeks/

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This is only one example. Cities all around the world are waking up to the benefits of e-technology.

Santiago, the capital city of Chile, recently procured 200 electric buses, with Chilean President Sebastián Piñera declaring Chile would become second only to China in terms of electric buses. [5]

This year, Delhi, India could become home to 1000 pure electric buses as draft policy seeks to make 50% of its bus fleet zero emission by 2023.[6]

In Nepal, the government has announced a decision to procure 300 pure electric buses for its capital of Kathmandu.[7]

So while progress is being made in London, the Mayor is making a false claim to suggest London is already amongst the world leaders in e-bus procurement.

It is not until 2037 that the Mayor hopes to achieve his vision of a ‘zero-emission’ bus fleet– a commitment he explicitly made in his Transport Strategy last year.[8] And with TfL finances in increasingly dire straits, he will need to look at innovative ways to achieve even this target.

Clearly, faster progress is needed in cleaning up London’s bus fleet.

This report explores the Mayor’s boasts about his electric bus fleet, looking at the reality of the situation and arguing that while resources have been misused in the past by previous Mayors, Sadiq Khan has failed to seize several opportunities which would better help him achieve his ambitions of a greener fleet - and quicker.

By looking at specific case studies of cities such as Eindhoven and Shenzhen it becomes clear there are a wealth of options the Mayor is yet to utilise which would help accelerate full e-fleet deployment in London.

Road pricing, bendy buses, and the fast-tracking of single decker bus procurement are all options that the Mayor should give greater attention to.

And with twelve low emission bus zones set to be completed in London by the end of 2019, the stage is already set for increased electrification.

[5] https://santiagotimes.cl/2018/12/13/chile-drives-into-future-with-largest-electric-bus-fleet-in-latin-america/
[6] https://cleantechnica.com/2019/01/04/delhi-policy-draft-calls-for-25-evs-by-2023/
[7] http://kathmandupost.ekantipur.com/news/2018-12-27/government-to-purchase-300-electric-buses.html
[8] https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf Pg. 111

Introduction

However, at a time when the Mayor, a proud son of a bus driver, is looking to cut bus services, there is concern that he might renege on some of his pledges to clean up the fleet.

Rather than taking a step back I argue that he should seize this opportunity to rethink his pledges and produce a far more radical vision for the future of London's buses.

London can be a world leader in clean bus technology, but only if the Mayor is more innovative in his approach.

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Liberal Democrat Londonwide Assembly Member

Cleaner bus technologies – what's the difference?

Over the last two decades, in the face of ever-growing warnings over London's air quality and the challenges of climate change, TfL has sought to harness the potential of alternative energy sources to clean up its fleet.

This has resulted in the adoption of various bus technologies including hybrid diesel-electric, hydrogen fuel cell and pure electric buses.

But what's the difference?

Hybrid diesel-electric

With a fleet of just over 3,500 hybrid buses (including New Routemasters), TfL has embraced hybrid technology as an interim improvement on the heavily polluting diesel buses which still dominate the wider fleet.

Indeed, the Mayor has pledged that all double decker buses in central London will be hybrid by 2019.[9]

However, while these hybrids produce approximately 40 per cent less CO2 than the standard diesel buses, there have been a number of problems regarding their reliability.

Back in 2015, the BBC reported claims that the hybrid system in New Routemasters did not work 90 per cent of the time, with drivers therefore running their buses on diesel. This of course, would counter the benefits of using hybrid technology.[10]

In addition, hybrid batteries need to be renewed numerous times during the lifespan of the bus, and with some of these components needing to be imported from overseas, there are further disadvantages.[11]

Yet £350 million was spent on New Routemasters, the price tag of each bus coming in at around £50,000 more than a standard hybrid bus.[12]

During the tender process, Wrightbus, the eventual winner, scored last in terms of pricing, compared with the three other bidders.

It won because it supposedly performed well elsewhere, including in the technical and commercial categories, and thus had the highest score overall. [13]

[9] https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/cleaner-buses
[10] https://www.bbc.co.uk/news/uk-england-london-33569460
[11] https://www.horiba-mira.com/research/energy-vectors-in-powering-hybrid-buses
[12] https://www.bbc.co.uk/news/uk-england-london-37323431
[13] New Bus for London – PRO1632 Review Panel – 2 October 2009

Cleaner bus technologies – what's the difference?

At the time I expressed my concerns that the procurement of these expensive buses was little more than a vanity project and feared former Mayor Boris Johnson's obsession with the New Routemasters would leave London behind many cities worldwide in the adoption of 100 per cent electric buses.[14] I stand by this today.

These buses were incredibly expensive to both purchase and run, and fell far short of the environmental standards of pure electric buses.

And incredibly, the extravagant £350 million investment in these buses was not the end of the story. A further £2 million was needed to retrofit the "cauldron on wheels" with opening windows.[15]

The money wasted here should have been spent investing in pure electric buses instead.

Hydrogen fuel cell

Despite still possessing only 10 hydrogen fuel cell buses in its 9300-strong fleet, when first introduced in 2010, TfL's hydrogen buses formed the first 'zero-emission' bus fleet in the UK and was the largest of its kind in Europe.[16]

These zero tailpipe emission buses, emitting only water, were placed along the RV1 route - passing through some of London's most polluted areas – where they remain in service today.

However, TfL's recent consultation on bus services puts a serious question mark over the future of hydrogen fuel cell buses in London's fleet.[17]

Under the consultation, it is proposed that the RV1 route is scrapped, and I understand that if this transpires, TfL plans to retain only two of the ten hydrogen buses which operate on this route. These will be deployed along another yet-to-be-confirmed route, while the remaining vehicles are taken off the roads.

One can only question whether this is an economically-led decision to scrap what is considered very expensive technology or whether the buses have simply reached the end of their lifespan.

[14]http://www.londonlibdems.org.uk/_london_has_paid_and_will_continue_to_pay_an_incredible_price_for_boris_johnson_s_obsession_with_the_new_routemaster_bus_caroline_pidgeon
[15] https://www.bbc.co.uk/news/uk-england-london-34293388
[16] https://tfl.gov.uk/info-for/media/press-releases/2010/december/mayor-of-london-unveils-hydrogen-bus-fleet-for-the-capital
[17] https://consultations.tfl.gov.uk/buses/central-london/

But more importantly, such a decision would call into question whether any future procurement of hydrogen buses will be abandoned in favour of pure electric models.

Many of the Mayor's pledges for a cleaner fleet refer to 'zero-emission' technology – compromised of hydrogen fuel cell and electric vehicles. However, it may well be the case that the former is no longer regarded as a solution, with pure electric vehicles becoming the favoured means of achieving a 'zero-emission' fleet.

Whatever the real reason for this proposal, the Mayor must spell out the future of hydrogen fuel cell buses.

Pure electric

Operated via an electric motor, which is in turn powered by a lithium-ion battery charged using mains electricity, pure electric buses are another example of zero tailpipe emission technology.

However, pure electric buses have a lower capital and operating cost than hydrogen fuel-cell buses.[18]

Despite this, take up of pure electric technology has been slow. This is because while such buses are cheaper than hydrogen fuel-cell, they still cost considerably more upfront than conventional diesel/hybrid buses do. They also need the infrastructure to support consistent charging and installing vehicle charging interfaces is often a significant infrastructure project.

However, Bloomberg New Energy Finance has claimed that electric buses will reach unsubsidised upfront cost parity with diesel buses by around 2030. By then, the battery pack in the average e-bus would amount to only around 8 per cent of the total price –a fall from around 26 per cent in 2016. [19]

Further still, increasing worldwide demand for electric buses could bring battery prices down faster. If this is the case, electric buses could reach cost parity with their diesel counterparts by the mid-2020s.

Until then, cities such as Shenzhen in China have already proven how the adoption of pure electric technology can be made cheaper.

[18] https://www.lowcvp.org.uk/assets/reports/A%20Green%20Bus%20for%20Every%20Journey.pdf – Pg. 21
[19] https://c40-production-images.s3.amazonaws.com/other_uploads/images/1726_BNEF_C40_Electric_buses_in_cities_FINAL_APPROVED_%282%29.original.pdf?1523363881

Understanding zero-emission

It is important to note that while pure electric and hydrogen vehicles are often described as zero emission, this is not the case. Rather, they are zero tailpipe emission vehicles – meaning they produce zero harmful exhaust emissions. Ancillary systems such as heating may run on alternative energies which still produce harmful gasses.

To date, all UK electric buses have been fitted with diesel heaters. The rationale for this has been that heating draws a considerable amount of energy from the battery and as a consequence, can significantly impact on the available range of the vehicle.

The Low Carbon Vehicle Partnership is working with manufacturers and technology providers to assess the impact of these diesel heaters on air quality; encouraging all stakeholders to adopt zero emissions heating.[20]

First and foremost, the Mayor should be clearer when relaying his targets for cleaning the bus fleet, and not boast of a fleet which is and will not be truly zero-emission.

Secondly, if he is truly committed to cleaning up the fleet, he should be closely working with the sector to explore the feasibility of zero emission ancillary systems and work to ensure they can be incorporated into the fleet as soon as possible.

[20] https://www.lowcvp.org.uk/Hubs/leb/ultra-low-emission-bus.htm

London’s current bus fleet

So how does the current bus fleet compare when it comes to take-up of these various technologies?

In his 2016 Mayoral manifesto, Sadiq Khan said he would “create a race to the top in clean bus technology”.

Further, he rightly acknowledged that air quality and climate change are such pressing issues that London should seek to provide international leadership in tackling their adverse effects.[21]

Yet as things stand, London is not leading the way when it comes to greener and cleaner technology.

Certainly, progress is being made in cleaning up the fleet. Approximately 86 per cent of buses in central London are ULEZ (Ultra Low Emission Zone) compliant while more than 60 per cent of the fleet is now at the ultra-clean Euro VI engine emission standard. This is the result of a concerted effort by the Mayor and TfL to ensure the entire fleet meets the cleanest Euro VI standard by 2020.

With an £85 million programme to retrofit older buses, approximately 2,000 buses have now been retrofitted with special exhaust control systems that meet or exceed the cleanest Euro VI emission standards.[22]

But can the Mayor really claim to be leading the way in adopting new technology, and accelerating the switch to new, cleaner vehicles?

TfL endeavours to publish quarterly updates on their bus fleet. The latest publicly available data however, details the fleet as at 31st March 2018.[23] For the purpose of this report, I will be referencing much more up to date figures. These were obtained directly through TfL, and provide estimates which are correct as at November 2018.

These figures show, that as at November 2018, TfL operated a bus fleet of approximately 9,300 buses; 130 of which were pure electric (Fig.1)[24] This makes for a mere 1.4% of the total fleet.

[21]http://d3n8a8pro7vhmx.cloudfront.net/themes/569cb9526a21db3279000001/attachments/original/1457451016/x160668_Sadiq_Khan_Manifesto.pdf?1457451016 – Pg. 64
[22] https://www.london.gov.uk/press-releases/mayoral/tackling-londons-lethal-air
[23] http://content.tfl.gov.uk/bus-fleet-audit-31-march-2018.pdf
[24] 96 are currently in operation. While the remaining 34 are not yet in service, TfL have told they will be by the end of the financial year

London’s current bus fleet

Taking into account the hydrogen fuel cell buses in operation, of which there are 10, only 1.5% of London’s bus fleet is currently zero-tailpipe emission.

Fig.1. London’s current bus fleet (November 2018)[25]

Total fleet	**9300**
Diesel	**5650**
Diesel-electric hybrids	**3510**
Zero-emission hydrogen fuel cell	**10**
Zero-emission pure electric	**130**

Clearly, while the Mayor has made a significant impact in reducing the emissions of his fleet, efforts to advance the transition to a zero-tailpipe emission fleet are going at a snail’s pace.

We only need to look across the water at countries such as the Netherlands to see a much more committed, and innovative approach. Further afield, China is a world-class example of how the expansion of a pure electric bus fleet could and should be embraced.

[25] TfL

The Mayor's pledges

So, what are the Mayor's ambitions for a cleaner and greener bus fleet?

In his Transport Strategy, the Mayor pledged that[26]:

- **All new buses will be hybrid, electric or hydrogen from 2018**
- **All double decker buses in central London will be Euro VI and hybrid by 2019**
- **All single decker buses in central London will be pure electric or hydrogen by 2020**
- **All new double decker buses will be electric or hydrogen by 2025**
- **All buses will be zero emission or hybrid by 2030**
- **All single decker buses pure electric or hydrogen by end of 2035**
- **All buses to be zero-emission by 2037 at the latest**

These pledges are then supported by the roll-out of twelve Low Emission Bus Zones, with only those buses with "top-of-the-range engines and exhaust systems that meet or exceed the highest Euro VI emissions standards" able to operate within its boundaries. [27]

The first two of these clean bus zones were launched in 2017 in Putney High Street and Brixton Road, while in November 2018, the Mayor launched a further five. This now brings the current total to seven, with the Mayor also promising that the final five zones will be completed ahead of schedule by the end of 2019.[28]

While these zones have an important part to play in increasing transport electrification, if you consider that TfL's fleet is only 1.4% pure electric at present, growing to only 2.6% by summer 2019, the Mayor has a long way to go if he is to achieve a 'zero-emission' fleet by 2037.

This pledge is far from ambitious to begin with - and such a fleet should be achieved much sooner - but given the slow progress so far I question whether the Mayor will even meet this target.

[26] https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf Pg. 111
[27] https://tfl.gov.uk/modes/buses/improving-buses?intcmp=42923%20-%20on-this-page-0#on-this-page-0
[28] https://www.london.gov.uk/press-releases/mayoral/tackling-londons-lethal-air

The Mayor would have to replace over 500 buses a year with pure electric or hydrogen buses if he is to achieve his target of a 'zero-emission' fleet by 2037.

Indeed, while TfL's latest publicly available bus fleet audit doesn't provide us with the most up-to-date figures, it does give a helpful overview of the rate of progress in adopting zero emission technology up to March of last year.

Fig. 2 London bus fleet by type – 31st March 2015 to 31st March 2018[29]

Bus Type	Drive train type	31/03/15	31/03/16	30/06/16	30/09/16	13/01/17	31/03/17	30/06/17	30/09/17	31/03/18
New Routemaster	Hybrid	432	736	801	833	873	953	978	983	**1000**
Routemaster	Diesel	19	10	10	10	10	10	10	10	**10**
Artic	Diesel	-	-	-	-	-	-	-	-	**-**
Single deck	Diesel	2662	2617	2611	2622	2601	2612	2616	2608	**2587**
	Fuel Cell	8	8	8	8	8	8	8	10	**10**
	Hybrid	23	18	6	22	43	18	18	27	**13**
	Electric	8	17	17	34	66	66	66	68	**91**
Double deck	Diesel	5026	4794	4777	4668	4591	4380	4156	3926	**3453**
	Hybrid	799	981	1132	1260	1391	1564	1733	1912	**2227**
	Electric	-	5	5	5	5	5	5	5	**5**
TOTAL		8977	9186	9367	9462	9588	9616	9590	9549	**9396**

For example, Fig. 2 shows us that the roll-out of electric single decker buses is only marginally increasing, and certainly not at the rate that would be needed for the Mayor to achieve his 'zero-emission' target by 2037.

[29] http://content.tfl.gov.uk/bus-fleet-audit-31-march-2018.pdf

Single decker buses

According to the latest information from TfL, approximately 2,600 vehicles in London's current 9,300 strong bus fleet are single decker.[30]

The Mayor's Transport Strategy sets out his targets for all single decker buses in central London to be electric or hydrogen by 2020 – the key phrase being 'central London'.

Regularly, I see the media referencing the Mayor's plans for a 'zero-emission' single decker fleet by 2020. In fact, only last month The Guardian made this mistake.[31] This is not the case. Only those in central London will make the switch by 2020, and this is a smaller target considering the vast majority of London's single decker buses are deployed in inner or outer London.

In fact, of the approximate 2,600 single decker buses, fewer than 200 operate in central London.[32] This means that only 7.7% of the single decker bus fleet will be electric or hydrogen by 2020.

Central, Inner and Outer London are defined in the Transport Strategy as being[33]:

• Central London: an area broadly equivalent to the Central Activities Zone (CAZ), as defined by the London Plan. This includes parts of City of London, Camden, Hackney, Islington, Kensington & Chelsea, Lambeth, Southwark, Tower Hamlets, Wandsworth and Westminster.

• Inner London (excluding central London, as appropriate): the boroughs of Camden, City of London, Hackney, Hammersmith & Fulham, Haringey, Islington, Kensington & Chelsea, Lambeth, Lewisham, Newham, Southwark, Tower Hamlets, Wandsworth and the City of Westminster, as defined by the Office for National Statistics

• Outer London: the boroughs of Barking and Dagenham, Barnet, Bexley, Brent, Bromley, Croydon, Ealing, Enfield, Greenwich, Harrow, Havering, Hillingdon, Hounslow, Kingston upon Thames, Merton, Redbridge, Richmond upon Thames, Sutton and Waltham Forest, as defined by the Office for National Statistics

By 2035 the Mayor expects the single decker bus fleet in inner and outer London to have made the switch to electric or hydrogen technology. That means it will be sixteen years until the full single decker fleet becomes zero tailpipe emission.

[30] TfL
[31] https://www.theguardian.com/cities/2018/dec/12/silence-shenzhen-world-first-electric-bus-fleet
[32] TfL
[33] https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf - Pg. 313

Single decker buses

When we look at the breakdown of pure electric buses currently operating in the fleet, it is clear that single decker buses are more popular – comprising 85% of the electric bus fleet (Fig.3).

Fig.3 London's pure electric buses (November 2018)[34]

Make	Single or double decker	Number of vehicles	Routes	Capacity
BYD	Double decker	5	98	87 passengers
ADL/BYD	Single decker	110	70, 153, 360, C1 507/521	Approx. 60 (short version) Approx. 70 (long version)
Irizar	Single decker	2	108	61 passengers
Optare	Single decker	13	312, H98	59 passengers

This is a result of single decker electric buses being more widely available, and smaller battery technology. [35]

I therefore propose that there should be a dedicated commitment to phasing in more electric single decker buses as existing single decker buses come to the end of their lifespan and new bus contracts come up.

This would ensure a much faster transition to a pure electric single decker fleet, which would in turn go some way in helping to fast-track the electrification of London's full bus fleet.

[34] TfL
[35]https://cleantechnica.com/2015/07/06/london-gets-worlds-first-double-decker-electric-buses-clean-bus-summit-starts-bang/

Lessons from abroad

The Mayor may boast that London is to become home to Europe's largest double decker electric bus fleet but let's put this into perspective.

Every week, China deploys 9,500 electric buses on its roads – the size of London's entire fleet.[36]

And as part of the government's strategy to tackle pollution, more than 30 cities across the country have committed to operating 100 per cent electric public transport by 2020.[37]

Like London, China's rapidly growing city of Shenzhen has been plagued by diesel pollution. While buses account for only 0.5 per cent of its vehicles, they were to blame for 20 per cent of the city's overall transport emissions.

In only nine years, the city electrified its entire 16,000 strong fleet, becoming the first city in the world to do so.

Shenzhen's success serves as a lesson to mega-cities such as London, highlighting how challenges regarding charging infrastructure and high capital costs can be overcome.

Strong political will has driven the e-fleet aspiration into a reality, with several different policies and business models adopted over the years to mitigate the risks involved with adopting e-technology.

A national electric vehicle demonstration programme put the wheels in motion in 2009, as Shenzhen became one of ten Chinese cities to accept the challenge of deploying at least 1,000 electric vehicles annually over a three-year period.

Since then, measures such as passing responsibility for maintaining batteries and scrapping old diesel buses to manufacturers rather than bus operators have been adopted; helping to better distribute operational risks among the various stakeholders.

National and regional subsidies played a big part in the procurement of the buses, and helped offset the challenge of high upfront costs, bringing them to below that of a standard diesel bus.

[36] https://www.weforum.org/agenda/2018/04/china-is-adding-a-london-sized-electric-bus-fleet-every-five-weeks/
[37] https://www.standard.co.uk/futurelondon/cleanair/shenzhen-leads-the-way-in-electric-buses-and-taxis-a4016176.html

Lessons from abroad

Additionally, it was also understood that despite their higher cost, operational and maintenance costs over the lifespan of the vehicle were considerably lower than standard diesel buses. [38] Thus, greater investment would pay off in the long term.

This has been reiterated by Bloomberg New Energy Finance which, in a recent report on global e-bus roll-out, also found that while batteries account for approximately one-quarter of the price of the vehicle, the cost of batteries is expected to reduce to around 8 per cent of the total in the next decade.[39]

Now, Shenzhen's fully electric bus fleet is officially in operation, and all 22,000 of the city's taxis were also required to switch to electric by the end of 2018.[40]

The city's success in making the electric switch will no doubt serve as a catalyst to other Chinese cities, around 30 of which are well on their way to achieving their targets of 100 per cent electric public transport by 2020.

This case study also serves as a reminder that the London Mayor's plans for a 'zero-emission' bus fleet by 2037 is wholly unambitious.

Of course, the Mayor would need considerable sums to raise the capital necessary to invest in and grow the e-fleet at a much faster pace. And with the Crossrail delay straining TfL's finances further, the Mayor needs to be much more innovative when it comes to raising capital.

I believe road pricing could provide the answer.

[38] https://www.wri.org/blog/2018/04/how-did-shenzhen-china-build-world-s-largest-electric-bus-fleet
[39] https://c40-production-images.s3.amazonaws.com/other_uploads/images/1726_BNEF_C40_Electric_buses_in_cities_FINAL_APPROVED_%282%29.original.pdf?1523363881
[40] https://www.theguardian.com/cities/2018/dec/12/silence-shenzhen-world-first-electric-bus-fleet

Lessons from abroad

In January 2017, the London Assembly Transport Committee published our ‘London Stalling: Reducing Traffic Congestion in London’ report, recommending the Mayor looks at introducing road pricing in London.[41]

We argued that the Congestion Charge should be replaced with a new citywide road pricing scheme, which charges vehicles according to the extent, location and timing of their road usage.

Not only would this be fairer, charging road users in accordance with how much they contribute to congestion, but it would be a twofold approach to tackling congestion – deterring personal vehicle usage and encouraging greater bus travel, while also helping to fund greener transport.

Indeed, the money raised by the charge could then be reinvested in the public transport network, such as in the procurement of pure electric buses and the charging infrastructure needed for much faster expansion of a pure electric bus fleet.

Since the publication of this report, the Mayor has published his Transport Strategy, in which he acknowledged the “fundamentally inadequate and unfair way in which road use is paid for in London, with motorists paying too little”. [42]

Proposal 21 of the strategy then goes further[43]:

> **Proposal 21**
>
> “The Mayor, through TfL, will investigate proposals for the next generation of road user charging systems. These could replace schemes such as the Congestion Charge, Low Emission Zone and Ultra Low Emission Zone. More sophisticated road user charging and/or workplace parking levy schemes could be used to contribute to the achievement of the policies and proposals in this strategy, including mode share, road danger reduction and environmental objectives, and to help reduce congestion on the road network and support efficient traffic movement. In doing so, the Mayor will consider the appropriate technology for any future schemes, and the potential for a future scheme that reflects distance, time, emissions, road danger and other factors in an integrated way. TfL will develop the design, operation and technical elements of these proposals in consultation with road users and stakeholders”.

More recently TfL’s 2018 Business Plan - published in December - explicitly states the need for "long-term solutions to the problems of excess road demand and insufficient funding”. Going further, it notes that beyond 2021, the next generation road user charging will need to be considered.[44]

To honour these commitments, the Mayor and TfL must undertake a full feasibility study and impact assessment on the potential of rolling out a road pricing scheme before consulting Londoners on their views.

[41] https://www.london.gov.uk/sites/default/files/london_stalling_-_reducing_traffic_congestion_in_london_0.pdf
[42] https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf – Pg. 287
[43] https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf – Pg. 93
[44] http://content.tfl.gov.uk/fc-20181213-item07-tfl-business-plan-approval.pdf - Pg. 25

Lessons from abroad

Case Study: **Eindhoven**

Population: approx. 227,000[45]

Electric buses: 43 articulated buses (18m)

Made by: VDL

Owned by: Connexion

Model: Citea SLFA Electric model

In December 2016, Eindhoven, a city in the south of the Netherlands, introduced a fleet of 43 pure electric buses. While this might not seem substantial, it's important to note that this fleet serves a population of only 227,000 while London's current 130 strong fleet serves a population of over 8 million.

Additionally, while these aren't double decker buses, at 18 metres long, these articulated, or 'bendy buses' are 50 per cent longer than London's standard electric buses[46]. This enables each bus to carry 43 seated, and 82 standing passengers.

Comparatively, London's highest capacity electric buses – of which there are only 5 – carry a total of 87 passengers. The most commonly used electric model used in London, of which there are currently 110, carry 70 passengers at most.

Evidently, bendy buses offer the benefit of a considerably larger capacity and is something which the Mayor could look to adopt – particularly in outer London where they could work better than standard buses.

Of course, the procurement of bendy buses is not a new idea. While they once existed on London's roads, Boris Johnson ran on an election pledge to remove them from service and by 2011, London's bendy buses were no more.[47]

However, in our 2017 'London's bus network' report, the Transport Committee recommended a move to a more efficient bus network based on the principles of the feeder/trunk model. This would see shorter, local bus routes connecting people to faster, high-capacity services on major corridors.

As part of this, we suggested that articulated, or bendy buses could be the best option for such routes because of their higher capacity, and capability for faster loading/unloading compared to standard double decker vehicles. [48]

So, despite being controversial, bendy buses clearly have their benefits, and should be something the Mayor considers as he looks to grow his e-fleet.

Indeed, having already mentioned that single decker electric buses are easier to procure, Eindhoven's case serves to highlight the success of electric bendy bus roll-out – something which the Mayor could possibly mimic.

Given the Mayor's promises to improve the bus service network in outer London, this case study provides a strong foundation for exploring the feasibility of bendy bus roll-out in such boroughs.

[45] As at 2017 https://www.statista.com/statistics/862755/total-population-of-eindhoven/
[46] https://plugin-magazine.com/driving/report-electric-buses-in-eindhoven/
[47] https://www.bbc.co.uk/news/uk-england-london-16091997
[48] https://www.london.gov.uk/about-us/london-assembly/london-assembly-publications/londons-bus-network

Recommendations

1 Come clean on the future of hydrogen buses

The Mayor must quickly spell out the future of hydrogen fuel cell buses in the capital given that most of those deployed along the RV1 route face potential scrappage.

More specifically, he must clarify whether this would be an economically-led decision; whether the vehicles have simply come to the end of their lifespan; or whether the decision would signal a move away from hydrogen fuel cell technology entirely.

2 Be clearer in distinguishing between zero-emission and zero-tailpipe emission

The Mayor should be clearer when relaying his targets for cleaning the bus fleet, and not boast of a fleet which is and will not be truly zero-emission.

Secondly, if he is truly committed to cleaning up the fleet, he should be closely working with manufacturers and technology providers to explore the feasibility of zero emission ancillary systems and work to ensure they can be incorporated into the fleet as soon as possible.

3 Fast track single decker electric bus procurement

There should be a dedicated commitment to phasing in more electric single decker buses as existing single decker buses come to the end of their lifespan and new bus contracts come up.

We know that single decker electric buses are more widely available and the battery technology is easier than their double decker counterparts. Thus, as TfL's current single decker buses reach the end of their lifespan, the Mayor should make sure that their replacements are pure electric, to ensure a much faster roll-out of a pure electric fleet.

4 Consult on road pricing

The Mayor and TfL must undertake a full feasibility study and impact assessment on the potential of rolling out a road pricing scheme before consulting Londoners on their views.

5 Undertake a feasibility study into the deployment of pure electric bendy buses in outer London

Given the Mayor's promises to improve the bus service network in outer London, he should explore the feasibility of bendy bus roll-out in outer London boroughs.

6 New fund for charging infrastructure

While I welcome the Mayor's launch of the EV Infrastructure Taskforce, I believe more needs to be done to advance roll-out of the right infrastructure, and I call on the Mayor to establish a dedicated fund for electric vehicle charging infrastructure.

Conclusion

The transition towards a fully electric bus fleet has begun. But far from creating “a race to the top in clean bus technology”, the Mayor has barely taken his foot off the starting blocks.

Indeed, while the political will for cleaning up the fleet is there, the ambition is lacking. The Mayor had an opportunity in his Transport Strategy to set out a far more ambitious road map for the transition to a pure electric fleet but sadly failed to do so.

Of course, electric technology isn’t perfect, and not all the measures and policies which worked well for Eindhoven and Shenzhen will work in London.

But what is clear, is that there are many untapped opportunities to be explored if the Mayor is serious about delivering his pledge of a ‘zero-emission’ fleet by 2037.

Electric battery technology costs are falling, and cities around the world are harnessing its potential; enhanced by initiatives such as road pricing and bendy bus procurement.

The Mayor needs to spend less time boasting about his green credentials, and more time thinking of innovative ways to fund and deliver a 100% zero-emission electric bus fleet, at a much faster pace.

Only then can London truly become a world leader in green public transport.